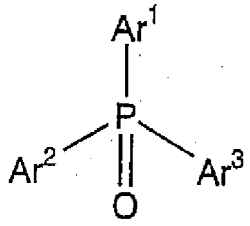
CLAIMS

1. An organic electroluminescent element comprising an anode, a cathode and a plurality of organic compound layers sandwiched between the anode and cathode, the organic compound layers including: a hole-transporting layer made of an organic compound insoluble in alcohols; and an electron-transporting layer formed on the hole-transporting layer by a wet method, the electron-transporting layer being made of a phosphorus-containing organic compound soluble in the alcohols.

2. The organic electroluminescent element according to claim 1, wherein the phosphorus-containing organic compound is a nonionic organic compound.

3. The organic electroluminescent element according to claim 1, wherein the phosphorus-containing organic compound has a molecular weight of 300-5000.

4. The organic electroluminescent element according to claim 1, wherein the phosphorus-containing organic compound is represented by the general formula (1):

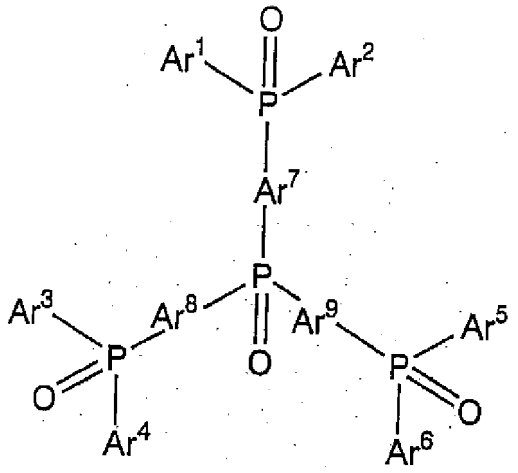


(1)

wherein Ar^1-Ar^3, the same or different from each other, represent an aromatic ring residue optionally containing a substituent.

5. The organic electroluminescent element according to claim 1, wherein the phosphorus-containing organic compound is represented by the general

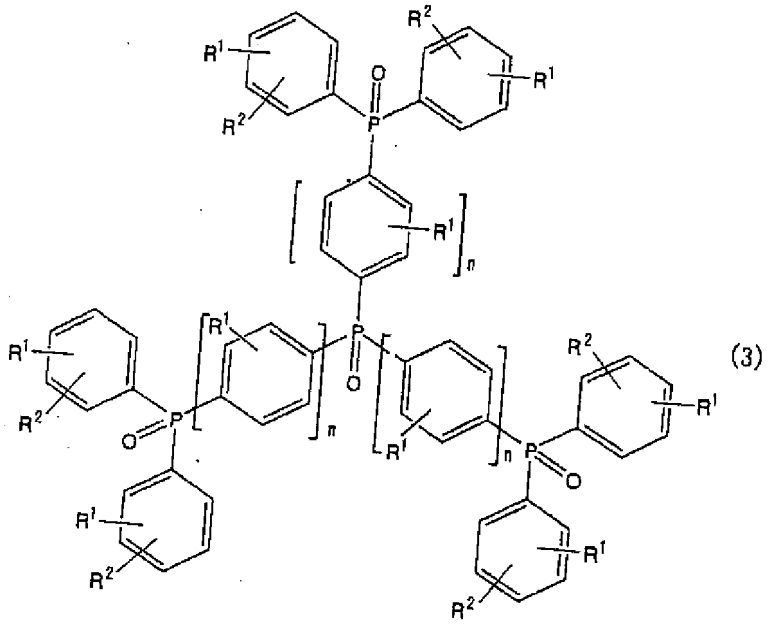
formula (2):



(2)

wherein Ar^1-Ar^6, the same or different from each other, represent an aromatic ring residue optionally containing a substituent; and Ar^7-Ar^9, the same or different from each other, represent an arylene group optionally containing a substituent.

6. The organic electroluminescent element according to claim 1, wherein the phosphorus-containing organic compound is represented by the general formula (3):



(3)

wherein R^1 or R^2, the same or different from each other, represents a hydrogen atom, an alkyl group, a halogen atom, cyano group, nitro group, amino group, an aryl group or a diarylphosphinyl group, and R^1 and R^2 can form, together with a carbon atom of a benzene ring to which they are linked, a substituted or unsubstituted aromatic ring; and n is 1 or 2.

7. A manufacturing method of an organic electroluminescent element including an anode, a cathode and a plurality of organic compound layers sandwiched between the anode and cathode, the process comprising the steps of: forming a hole-transporting layer using an organic compound insoluble in alcohols; and forming an electron-transporting layer on the hole-transporting layer by a wet method using as an electron transporting layer material a phosphorus-containing organic compound to be dissolved in an alcohol.

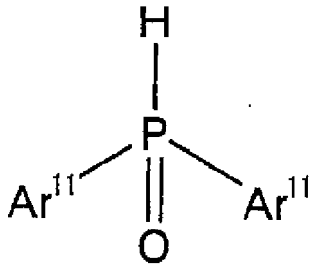
8. The manufacturing method of an organic electroluminescent element according to claim 7, wherein the alcohol is a linear or branched C_1-C_6 aliphatic alcohol.

9. The manufacturing method of an organic electroluminescent element according to claim 7, wherein the phosphorus-containing organic compound is represented by the general formula (1).

10. The manufacturing method of an organic electroluminescent element according to claim 7, wherein the phosphorus-containing organic compound is represented by the general formula (2).

11. The manufacturing method of an organic electroluminescent element according to claim 7, wherein the phosphorus-containing organic compound is represented by the general formula (3).

12. A phosphorus-containing organic compound as a condensation product of a compound represented by the general formula (4):



(4)

wherein Ar^{11}, the same or different from each other, represent a phenyl group or naphthyl group optionally substituted with a halogen atom, a lower alkyl group, a lower alkoxy group or a phenyl group, and either

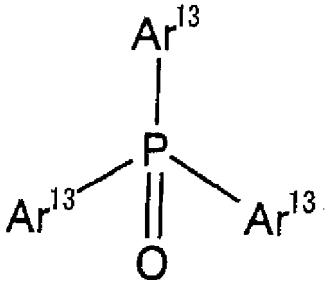
a compound represented by the formula:

Ar^{12}

wherein Ar^{12} represents benzene substituted with three halogen atoms, or benzene or biphenyl substituted with two halogen atoms

or

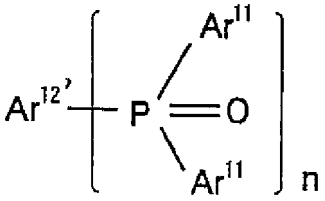
a compound represented by the general formula (5):



(5)

wherein Ar^{13}, the same or different from each other, are a phenyl group or biphenyl group optionally substituted with a halogen atom, at least two of Ar^{13} being a phenyl group or biphenyl group substituted with at least one halogen atom.

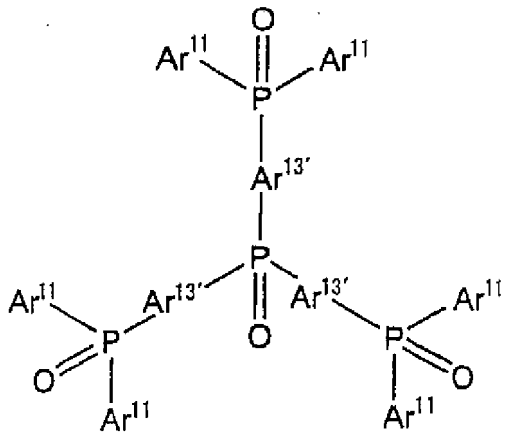
13. The phosphorus-containing organic compound according to claim 12, represented by the subformula (6):



(6)

wherein Ar^{11} has the same meaning as defined in the general formula (4); and $Ar^{12'}$ represents a phenylene group or biphenylene group when n=2 and a benzenetriyl group when n=3.

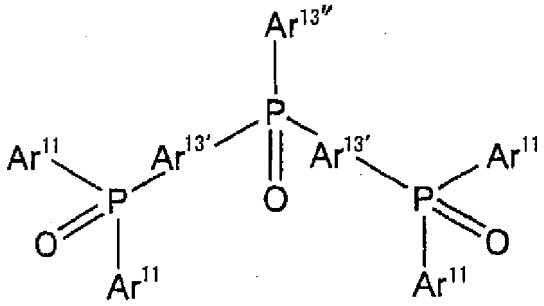
14. The phosphorus-containing organic compound according to claim 12, represented by the subformula (7):



(7)

wherein Ar^{11} has the same meaning as defined in the general formula (4); and $Ar^{13'}$, the same or different from each other, represent a phenylene group or a biphenylene group.

15. The phosphorus-containing organic compound according to claim 12, represented by the subformula (8):

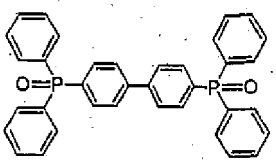


(8)

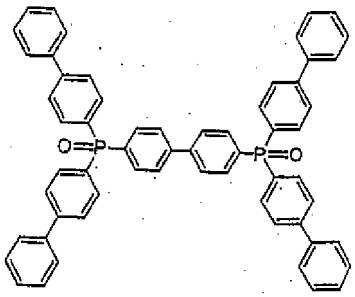
wherein Ar^{11} has the same meaning as defined in the general formula (4); $Ar^{13'}$, the same or different from each other, represent a phenylene group or a biphenylene group; and $Ar^{13''}$ represents a phenyl group or a biphenyl group.

16. The phosphorus-containing organic compound according to claim 12, selected from

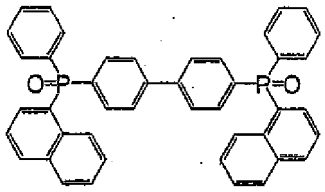
compounds of the subformula (6):



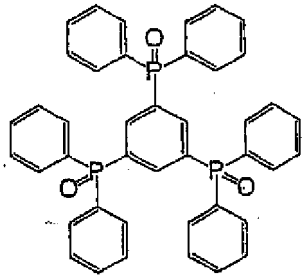
(A)



(B)

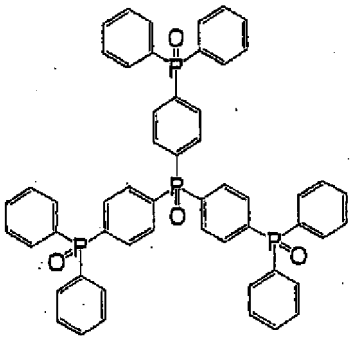


(C)

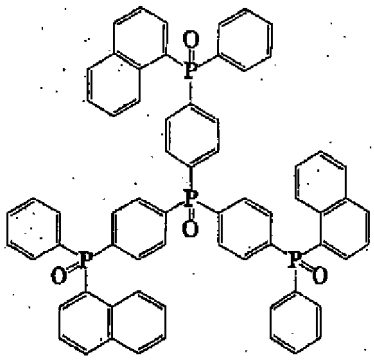


(D)

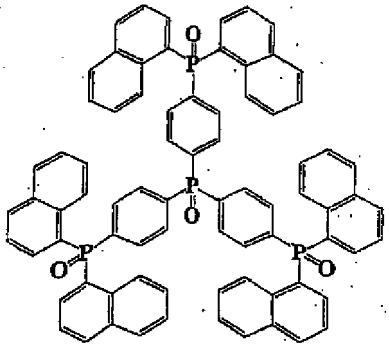
compounds of the subformula (7):



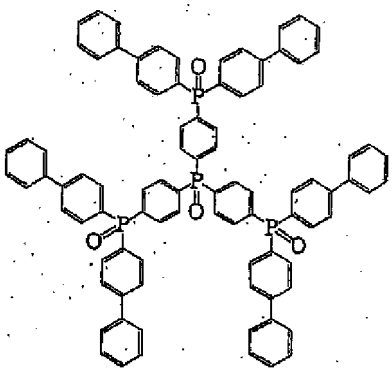
(E)



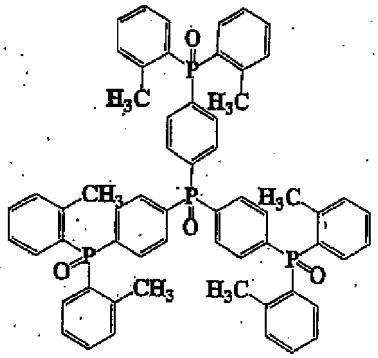
(F)



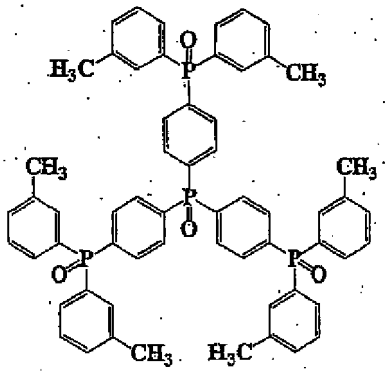
(G)



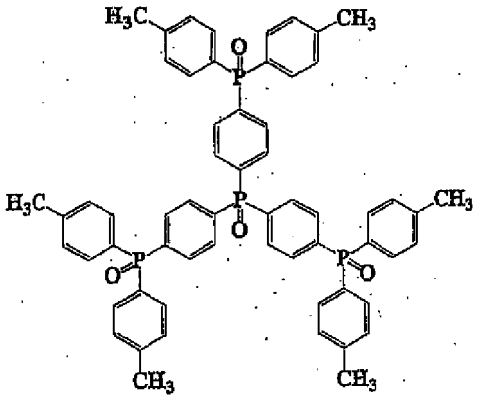
(H)



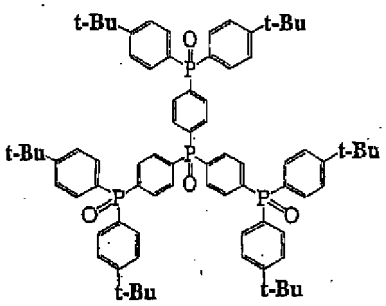
(I)



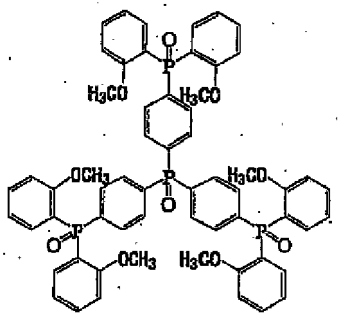
(J)



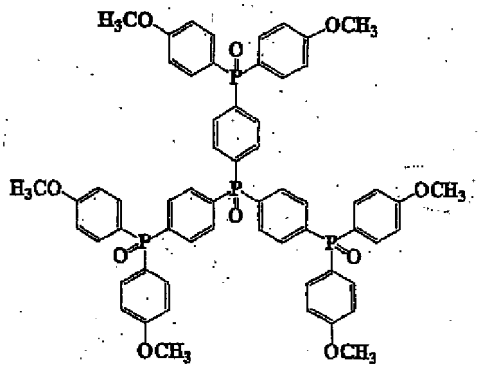
(K)



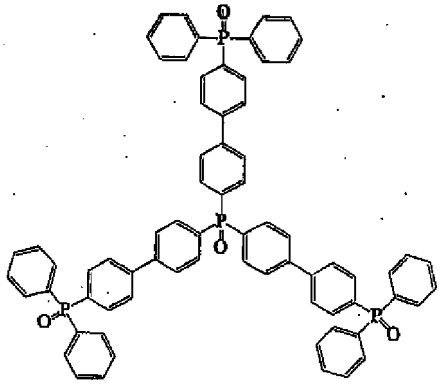
(L)



(M)



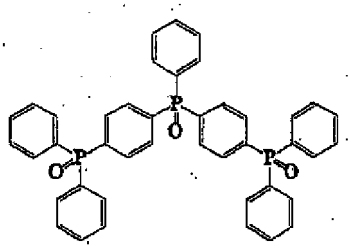
(N)



(O)

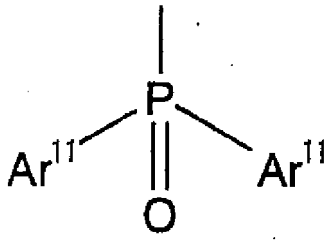
, and

compounds of the subformula (8):



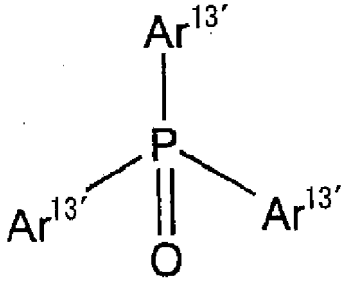
(P)

17. A phosphorus-containing organic compound having at least three partial structures represented by a diarylphosphine oxide skeleton, the diarylphosphine oxide skeleton represented by either the formula (9):



(9)

wherein Ar^{11} has the same meaning as defined in the general formula (4) or the formula (10):

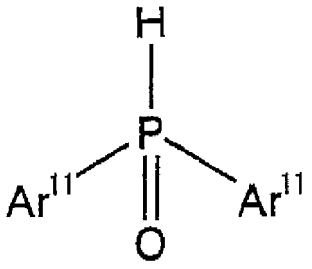


(10)

wherein $Ar^{13'}$, the same or different from each other, are a phenyl group or a biphenyl group, or a phenylene group or biphenylene group linked to the formula (9).

18. A manufacturing method of a phosphorus-containing organic

compound, comprising the step of condensing, in a solvent, in the presence of a condensing catalyst and a base, a compound of the general formula (4):



(4)

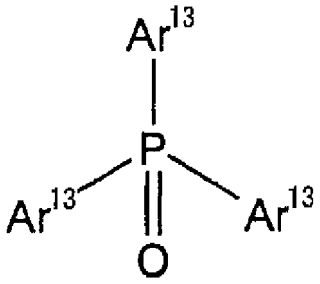
wherein Ar^{11} has the same meaning as defined in the general formula (4), with either a compound of the formula:

Ar^{12}

wherein Ar^{12} has the same meaning as defined in the above formula Ar^{12}

or

a compound of the general formula (5):



(5)

wherein Ar^{13} has the same meaning as defined in the general formula (5).

19. The manufacturing method of a phosphorus-containing organic compound according to claim 17, wherein the solvent is dimethyl sulfoxide, the condensing catalyst is palladium acetate or a complex compound of palladium acetate with either 1,3-bis(diphenylphosphino)propane or 1,4-bis(diphenylphosphino)butane, and the base is a trialkylamine, N-ethyldiisopropylamine, or N,N'-dimethylaminopyridine.